

SPACE PROPULSION SYMPOSIUM (C4)
Advanced and Combined Propulsion Systems (8)

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THE DEVELOPMENT OF OXYGEN-HYDROGEN ENGINE THAT USES WATER TO PRODUCE
HYDROGEN FUEL

Abstract

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Almost all existing propulsion systems (PS) of spacecrafts (SC) use either extremely expensive or toxic and hazardous chemical compounds as components of rocket fuel. The proposed PS uses as a working substance for the production of fuel propellants ecologically clean, safe and, surely, much cheaper and more widespread in the nature material - water. In this regard, the propulsion system advantageously differs with low cost and security of refueling operations when preparing the spacecraft for launch on landfill and environmental safety fuel components produced by water electrolysis. A new type propulsion system operating on ecologically pure gaseous fuel may be applied to obtain required level of thrust for SC's systems of orientation and stabilization. Thanks to its weight and size, performance and power consumption the advanced propulsion system can be used onboard spacecrafts operating on different orbits (HEO, geostationary and low earth orbits) with lifespan of not less than 5 years (up to 10 years). Layout scheme of the propulsion system includes the following main design elements: 1) the propellant generator (PG); 2) the working fluid dispenser (WFD); 3) the storage unit of the working fluid; 4) engines of orbit correction and SC's orientation; 5) the fuel storage unit; 6) refueling and start-up/ shut-off valves. The propellant generator intended to produce rocket fuel from the working fluid for PS's operation in the forward mode and for charging the fuel storage unit at pressures up to 150 ATM. It does not require additional energy to compress the gas. The fuel production process is stable, easily controlled and amenable to automatic control by changing the current in terms of required performance. The electric current is adjusted by applying the appropriate voltage to the PG in accordance with the selected thrust level. A regenerative mode is used to provide the decrease of pressure in the system to ensure safety and eliminate leakage of gas from the engine when it shuts down. The WFD supplies the working fluid into PG with a specified mass flow depending on the law changes of the selected thrust and total impulse (in terms of frequency of pulses from the control unit), and the cyclic flow of the working fluid in the accumulation mode of the fuel in the storage unit of fuel. The application of modern technologies in the production of components of the propulsion system and the low flow rate of the working fluid can reduce the specific gravity of the onboard propulsion system (relative to comparable samples) more than 2 times.